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Original Research Article

Anthropometric Analysis of Bicondylar Diameter and Its Medicolegal and Clinical Significance

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ABSTRACT

Background: Bicondylar diameter of the mandible varied among sexes. Sexual dimorphism on the basis of anthropometric analysis of bicondylar diameter has immense significance medicolegally. Lower jaw fracture with condylar displacement is common in road traffic accident. Resection of the mandible is indicated in carcinoma or osteomyelitis of the bone. For optimal occlusion, bicondylar diameter of the mandible must be maintained. Bicondylar diameter is useful tool for any reconstructive surgeries of lower jaw. Hence this study is aimed at to provide range of bicondylar diameter for accurate determination of sex and for effective surgical endeavour at this region.
Methods: Three hundred intact, dry mandibles of unknown sexes were studied. Distance between mandibular condyles was measured. All the data were analyzed for significance of the occurrence in relation to sex by means of paired t-test.
Results: The average bicondylar diameter was 117.59 mm in male and 107.61 mm in female. By comparing the data with non-metric analysis of the mandible, we got 97% accuracy in determination of sex. We found statistically significant difference among sexes.
Conclusions: Accurate determination of sex from mandible required wide number of data that could be utilized medicolegally and clinically.

Keywords: Anthropometry, Bicondylar diameter, Reconstruction surgeries, Sexual dimorphism.

INTRODUCTION

Anthropometric analysis of the mandible for sexual determination is an age old technique. Pelvis is the most common bone for sexual dimorphism; however, we could not get the entire skeleton in natural or manmade catastrophes where only single bone or its fragments are available. [1] In such cases, sexual determination with utmost accuracy would be difficult task for forensic expert. Loth et al. analysed mandibles non-metrically by seeing flexure on the posterior border of the ramus of the mandible, and other morphological features such as general size, chin shape, gonial angle, gonial flare, and muscular markings. [2]

As anthropometric analysis removes observational error, we measured bicondylar diameter for determination of sex. The present study is aimed at measuring bicondylar diameter of the mandible of unknown sexes to give the range of dimensions to determine the sex accurately.

MATERIALS AND METHODS

We included 300 dry mandibles of unknown sexes for this cross sectional study. The intact mandibles with either all teeth or intact alveolar margin have been included for the study; and mandibles without teeth or eroded alveolar margin were excluded in the study. All mandibles were procured from the Anatomy departments of different medical and dental colleges of the Gujarat, India. The bones were numbered serially.

Sexual determination has been carried out on the basis of presence or absence of a distinct flexure on the posterior border of the ramus at the occlusal plane, and other morphological features such as general size, chin shape, gonial angle, gonial flare, and muscular markings. [2] The mandibles were segregated on the basis of these non-metric criteria observed by author and one co-author into 150 male and 150 female mandibles.

We measured intercondylar distance between the exterior poles of the condyles, which is the largest distance and is accessible readily (Figure 1).

STATISTICAL ANALYSIS

The anthropometric data were tabulated in excel sheet. The data were compared with non-metrically segregated mandibles to determine the range of bicondylar diameters in male and female mandibles. Mean, standard deviation, range were determined using IBM SPSS statistics software 20.0 version. The data were analyzed for significance of the occurrence in relation to sex by means of paired t-test with the level of significance set at $p < 0.05$.

Figure 1: Measurement of bocondylar diameter

RESULTS

Mean, standard deviation and range (Figure 2 & 3) for bicondylar diameter of all the mandibles studied were calculated and noted in table 1.

Table 1: Descriptive statistical parameters of bicondylar diameter

Bicondylar diameter	Male	Female
Average	117.59	107.61
Standard Deviation	1.95	5.29

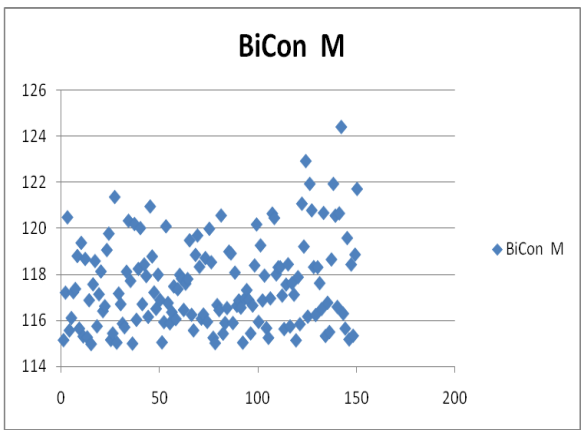

Figure 2: Bicondylar diameter in male mandibles

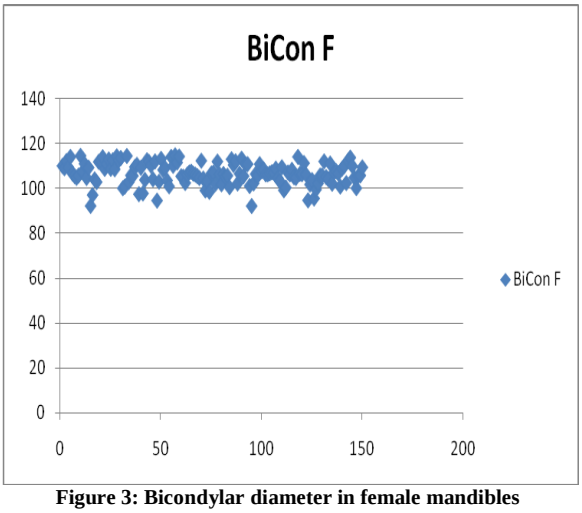

Figure 3: Bicondylar diameter in female mandibles

P-value of bicondylar diameter was found to be less than 0.05 suggesting significant statistically difference between male and female mandibles. By comparing our anthropometrical data with non-metrically segregated mandibles we got 97% accuracy in determination of sex.

DISCUSSION

Sexual determination by available bones or bone fragments is having immense importance medicolegally. The mandible is the most dimorphic part of the human skull and has been used for sexual dimorphism. [3]

Loth SR found 99% accuracy in determination of sex by finding flexure at posterior border of ramus of the mandible. [2] By observing flexure at the posterior border of the ramus of the mandible, Shivaprakash et al. determined sex with 80% accuracy in male and 71% in female mandibles. [4] Racial variations commonly found for bicondylar diameter and studied worldwide (Table 2)

Table 2: Comparison of the data of Bicondylar breadth measured in present study with other studies.

Authors and population	Male (Mean (mm) ± SD)	Female (Mean (mm) ± SD)
Tradowsy [5] (USA)	108 ± 7.2	102 ± 7.4
Lazic [6] (Croatia)	130.2 ± 6.7	123.5 ± 4.8
Kharoshah [7] (Egypt)	108.9 ± 7.7	99.6 ± 6.4
Marinescu [8] (Rome)	120 ± 5.4	113.1 ± 4.8
Vinay [9] (South India)	113.4 ± 5.5	108.2 ± 7
Franklin [10] (Western Australia)	113.6 ± 6	108.6 ± 5.8
Ongkana [11] (Thailand)	123.8 ± 6.3	116.1 ± 5.8
Present study	117.59 ± 1.95	107.61 ± 5.29

Average bicondylar diameter was varied amongst different region worldwide. Oberg and coworkers found rectangular, round towards oval, and pear shaped condyles with medial and lateral parts that have become thin. Differently shaped condyles have yielding varying intercondylar distance in the individual mandibles. [12] Sexual difference in bicondylar diameter could also be the result of different chewing habits and nutritional factors resulting. [13] Bicondylar diameter in Croatian people found by Lazic et al. was 5.25% larger than the maximal values of the same parameter in other populations suggesting larger craniofacial skeletons. [6] P-value of the bicondylar diameter showed statistically significant sexual difference and has been noted by all authors mentioned.

We found overall accuracy of bicondylar diameter to determine sex was 97%. Marinescu found the accuracy of bicondylar diameter to determine sex was 70% in male, 77% in female and 73.5%. [8] Vinay et al. found accuracy of sexual determination by using bicondylar diameter to be 70% in male, 77% in female and 73.5% overall. [9]

Apart from medicolegal importance bicondylar diameter has been considered as a possible predictor for the quality of mandibular reconstruction. Kruse et al. measured intercondylar distance pre-operatively and post-operatively and found no significant change in the pre- and post-surgical intercondylar distance. [14]

CONCLUSION

Discriminant analysis of bicondylar diameter has greater accuracy in determination of sex in case of only part of skeleton available as in case of mass

disaster. For more accurate results we need to analyze bicondylar diameter from different regions of India and worldwide to get wide range of data. These data could be utilized by surgeons for mandibular reconstruction for getting occlusion optimally.

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